Universitat de les Illes Balears

DEA WP no. 78
Working Paper Series

Gender, institutions and educational achievement: a cross-country comparison

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April 2016

Departament
d'Economia
Aplicada

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Abstract: An issue in the literature on educational production functions is the contribution of variables related to students' lifestyles towards explaining the gender gap in terms of educational achievement. We intend to shed further light on this issue by means of empirical evidence based on international data from 22 countries. In order to carry out this research, we analyze the effect of a set of variables from different international surveys that allow the study of the potential country-level factors which could influence this gap.

Our results show that it is essential to foster entrepreneurship attitudes among tertiary education students. On the contrary, until high school education years it could be counterproductive. It is also relevant to enhance girls' self-confidence in business management abilities, as they show a higher average risk-aversion than boys and they are also more affected by a range of gender stereotypes.

Keywords: gender; students' performance; institutions; stereotypes

Acknowledgements: This work has been partly supported by the Andalusian Regional Ministry of Innovation, Science and Enterprise (PAI group SEJ-532 and Excellence research group SEJ-2727); the Spanish Ministry of Economy and Competitiveness (Research Project ECO2014-56397-P) and scholarship FPU2014 04518 of the Ministry of Education, Culture and Sports [*Ministerio de Educación, Cultura y Deporte*].

1 Introduction

The existence of systematic gender differences in educational achievement is an issue that has received increasing attention in the past two decades, particularly since the international programs for the assessment of educational achievement have become popular (PISA, TIMSS, PIRLS, etc.). One of the most robust outcomes across assessment programs, countries and years is girls' superior performance in reading scores. According to, e.g., the PISA 2009 report (OECD 2010), girls achieve –in all the sixty-five participating countries– a higher average score (39 points -about half standard deviation-) in reading comprehension than boys.[1] On the contrary, it is frequently found that boys' outperform girls in mathematics, although this result seems to be more country-specific. In PISA 2009, boys had a higher mathematics achievement in –approximately– half of the countries and, in five countries, girls had a higher achievement in this subject. In PISA 2012 (OECD 2014a) girls outperformed boys in reading in all countries, with the same average differences across OECD countries as in PISA 2009, and boys continued to outperform girls in mathematics.

Taking these figures in isolation only provides us with a partial descriptive picture of the gender gap in educational achievement, because of the lack of information on the factors which triggered and help to sustain this situation. Among those factors, the existing cultural differences across countries could be one of the most relevant to explain it and, thus, they constitute our focus. The idea is to 'isolate' factors determining social relationships, advantages and resources of the individual that are due to the social status of his/her family, plus a range of social values, beliefs and institutions that shape individual and household behavior. According to this concept, the academic success of a person and his/her tendency to invest in education depends directly on those factors.

Thus, the main objective of this work is to determine the average effect of both micro-level and country-specific cultural factors on the differential educational performance of boys and girls, as well as to explore their impact along the performance distribution.

The differences in educational performance of men and women in compulsory education are particularly relevant to the extent that educational performance should act as a good predictor of the career progression of men and women along their adult lives (see, e.g. Dolton, Makepeace, and Marcenaro 2005; De Coulon, Marcenaro, and Vignoles 2011).

To carry out this analysis, we study the effect of a set of variables from different international surveys (PISA –Programme for International Student Assessment–, WVS –World Values Survey–, NES –National Expert Survey–, APS –Adult Population Survey), which have

[1] The results of the Program in International Reading Literacy Study (PIRLS) conducted in forty-nine nations in 2011 also show that girls outscore boys in reading (Mullis, Martin, Foy, and Drucker 2012).

not been employed before –to the best of our knowledge– in the study of the factors that influence students' differential achievement by gender. Specifically, our estimates focus on 22 developed and developing countries participating in the PISA project[2]. In addition to the individual-level variables commonly used in the education literature, we consider additional factors aggregated at the country level and grouped into education system characteristics, child qualities supported socially, views and opinions on gender roles, and risk-aversion attitudes, thus exploiting to its full potential the four datasets listed above.

2 Review of the literature

In the field of education and gender differences there are –essentially– two theoretical arguments to explain the gender gap in the academic performance of students: biological (a more conservative point of view) and social (more progressive).

Within the biological tradition, numerous studies argue that the differences in the composition of the brain (Kucian, Loenneker, Dietrich, Martin, and Von Aster 2005) explain the differences in educational achievement, while others establish that they are based on innate gender skills (Lawton and Hatcher 2005) or on the differences in study strategies between boys and girls (Kucian, Loenneker, Dietrich, Martin, and Von Aster 2005). An additional strand of the literature has pointed out the different rates of maturation (physical and mental) as an important cause to explain the differences between girls and boys in terms of educational performance (Camarata and Woodcock 2006).

The fact that girl-biased gender gaps in reading have been found across all OECD countries gives support to the innate difference theory. However, the substantial variation in the size of these gaps across countries does not. Indeed, according to Arnot, David, and Weiner (1999), it is quite difficult to resort to the biological aspects to account for differences in the educational attainment of men and women, because "they are often associated with the culture, period of that culture and the degree of development of boys and girls".

In our empirical specification, the existence of socially-induced gendered stereotypes is represented by education system characteristics, child qualities supported socially, views and opinions on gender roles, and risk-aversion attitudes.

The review of the literature shows that gender stereotypes are the result of "cultural heritage" that might be better observed at country-level because it represents those shared values and beliefs that are common to individuals with the same cultural background and that

[2] Argentina, Brazil, Chile, Colombia, Finland, Germany, Hong Kong, Hungary, Italy, South Korea, Malaysia, Netherlands, Norway, Peru, Russia, Serbia, Slovenia, Spain, Switzerland, United Kingdom, United States and Uruguay.

have been transmitted to them by their ancestors. The contribution of those gender stereotypes towards the differentiated academic achievement of boys and girls lends support to the social argument of the gender gap and ultimately justifies the relevance of our analysis.

3 Data and methodology

To address the empirical implementation of this research we rely on the statistical information obtained from different international surveys (PISA, WVS, NES and APS) which have not been employed before –to the best of our knowledge– in the study of the factors that influence students' differential achievement by gender. Specifically our analyses focus on 22 developed and developing countries participating in the PISA project in 2009 and 2012, centering on individual-level variables –from PISA– and factors aggregated at the country level –from WVS, NES and APS–, to evaluate their potential contribution to the differential educational performance of boys and girls, as well as to explore their impact along the performance distribution. In order to get a better temporal fit of the information from the aggregated factors with those of the individual-level variables, longitudinal data of the former factors for the period 2005-2009 has been employed.

With regard to those potential factors, they have been listed in Table 1, which also includes summary statistics for the whole sample under scrutiny distinguishing the international survey from which each variable has been obtained. The figures which appear in Table A1 (Appendix) show that the sample distribution of boys' and girls' characteristics is very similar with respect to the selected variables: 8% have immigrant parents, both genders are equally present in each socio-economic strata and household type (with 14-15% in single-parent homes and 3-4% living without parents), as well as in geographical areas (27% from Latin America and 9% from Asia).

Regarding the main variable of interest, educational performance, the graphical representation of its kernel distribution for the scores in the 22 countries reveals some important gender differences (Figures 1-3, Appendix). In both years (2009 and 2012), girls significantly outperform boys in reading, whereas the difference is not statistically significant in mathematics[3]. This overall conclusion is remarkably persistent across the two sample years and performance groups. In the regression analysis we shall use both years for robustness, as well as analyze the determinants of the gender gap at the lower and upper ends of the distribution.[4]

[3] The two-sample Kolmogorov-Smirnov test for equality of the distribution functions rejects the equality of boys and girls scores (0.1352 and 0.1242 with p-value=0.000 for reading 2009 and 2012, respectively; 0.0697 and 0.0676 with p-value=0.000 for maths 2009 and 2012, respectively).

[4] The lower and upper ends used correspond to those in PISA (OECD 2010)**.** From the econometric point of view, this issue could be analyzed using a quantile regression. However, this alternative is conceptually

-Insert Figures 1 to 3 here-

The preliminary analyses of the country-level variables show strong multicollinearity among them, thus to overcome this we have used a multivariate data reduction technique; specifically we have aggregated those variables into principal components. Each of the principal components, which will be the covariates used in the regression analysis, is a linear combination of the original variables obtained directly from the main survey datasets.

The regressions are run using OLS. An alternative multilevel specification was also estimated but the country-level random effects were not significant except for the benchmark and here results do not change. The OLS empirical specifications are defined as follows:

$$y_{ij} = \alpha + \sum_{k}^{r} \beta_k \, x_{kij} + \sum_{q}^{s} \delta_q z_{qj} + \sum_{l}^{p} \varphi_l \, w_{lj} + u_{ij}$$

where y_{ij} denotes students' scores in reading or mathematics; x_{kij} are the $k = 1, \dots, r$ individual level variables and β_k represents the influence of these variables on the dependent one; z_{qj} are the selected $q = 1, \dots, s$ principal components obtained from the previous principal components analysis, and δ_q represents their effect on the dependent variable; w are $l = 1, \dots, p$ country control groups and φ_l measures their influence on the dependent variable[5]; u_{ij} is a normally distributed error term with zero conditional mean and we assume that it is mean independent of the observable characteristics. This regression is calculated for each of the PISA waves –2009 and 2012–, differencing by both boys and girls. In addition, these groups of regressions are estimated for the subsamples of top performers and lowest performers, separately.

4 Regression results

4.1 Benchmark results

The base model for the whole sample is shown in Table 1. The individual-level variables are all highly significant and behave as expected. In particular, the estimated coefficients show the lower achievement of immigrant children –compared to natives– in the case of boys, about 28 points less in reading and over 31 points less in maths (approximately one third of the standard deviation), with immigrant girls slightly more disadvantaged in reading

problematic for our dependent variable because the thresholds that define "low performer" students and "top performer" students represent different points of the scores distribution depending of the country.

[5] Concretely, country control groups are the following: Latino American countries –Argentina, Brazil, Chile, Colombia, Peru and Uruguay–, Asian countries –Hong Kong and South Korea– and other countries –Finland, Germany, Hungary, Italy, Malaysia, Netherlands, Norway, Russia, Serbia, Slovenia, Spain, Switzerland, United Kingdom and United States–.

and maths than native girls. Numerous studies argue about the influence of this variable in the educational outcome (see, for example, Chiswick and Miller 2005; or Ammermüller 2007); most of them emphasize the relative importance of being immigrant compared to the potential influence of the own differential characteristics which immigrants have, such as occupation and education of their parents, the cultural and wealth level of the household or interest in studies (García-Pérez, Pinto-Prades, and Robles-Zurita 2010) . However, in Table 1 the gender differential is not statistically significant for the immigrant variable, so it can be said that in this data immigrant children are equally disadvantaged irrespective of being boys or girls.

-Insert Table 1 here-

The impact of the socio-economic status of the household is increasingly positive with respect to the benchmark category ("very low") and is generally higher for girls than for boys (with statistically significant differences in 2009), as well as higher for reading than for maths in most cases. For example, in 2009 girls living in households with very high socio-economic status achieved on average reading scores almost 79 points higher (equivalent to almost 1 standard deviation) compared to girls living in households with very low socio-economic status. A similar comparison with respect to the maths scores of boys reveals an average difference of over 74 points.

Living in a single parent household affects boys significantly more negatively (at least in 2009) compared to girls and maths scores more than reading ones. Even so, its effect is of a low magnitude, ranging from less than 2 points for girls' reading scores to over 7 points for boys' maths scores in 2009 (around 5 points in 2012). In our sample, 86% of single parents are mothers and, as the literature has shown, the absence of the father affects boys more than girls due to the importance of a father figure as a role model for boys in their teenage years (East, Jackson, and O'Brien 2006). Similarly, the father's absence affects maths scores more than reading ones, as maths are more related to "masculine" orientations (Murraya and Sandqvista 1990), thus also affecting boys more negatively in the subject that seems to be their comparative advantage with respect to girls. Likewise, boys are significantly more negatively affected than girls by living without parents, but this effect has a much larger magnitude, reducing boys' scores up to an average of 58 points and 46 points for girls. Thus, family structure affects educational performance and its gender gap in a significant way.

An important contribution of this paper is the identification of the country-level factors that help explaining the gender gap in scores beyond the influence of the individual-level factors already discussed. The fact that we find a substantial number of country-level factors that are highly significant demonstrates that students' performance in an international setting is affected by a range of cultural and institutional differences across countries. These are important beyond individual-factors and also beyond any characteristics that may be common to particular world

regions. In fact, in our sample Latin American countries show mean scores that are, on average, up to 140 points (2 standard deviations) lower than those of European countries, whilst Asian countries perform better on average, reaching mean scores that are up to 94 points above European ones. However, whereas in Europe girls perform better than boys in reading, in Latin America and Asia boys perform better than girls in both reading and maths. Since these unexplained regional differences appear in addition to a range of explained country-level factors, next we focus on the latter as their introduction constitutes a novelty of the paper.

As above mentioned, the country-level factors included in the specification belong to four main types. First, the *education system characteristics*, which are composed of two factors: 1) Primary and secondary education provide entrepreneurship values, and 2) Business education and universities provide entrepreneurship values. The kind of education system that provides entrepreneurship values can be described as one that encourages creativity, self-sufficiency and personal initiative. As can be seen in Table 1, this market-oriented education has a positive value at the level of tertiary education, but a negative one at the primary and secondary levels, with the effects being significantly larger for boys than for girls.

Second, the *views and opinions on gender roles* include: 1) Gender equality in entrepreneurship (Topic P); 2) Acceptance of gender discrimination in education and labour market; 3) Acceptance of alternative family forms; and 4) Women's independence. Whilst countries with gender equality values (in entrepreneurship, family forms and women's independence) have on average higher scores, those countries that accept gender discrimination in education and the labour market have on average lower scores. Moreover, gender equality in entrepreneurship contributes to the widening of the gender gap in reading and maths, acceptance of gender discrimination in education and labour market does so only in reading, and women's independence widens the gender gap in maths. On the contrary, the acceptance of alternative family forms reduces the gender gap. The two later results may be showing the positive influence that single-mother households may have on boys' achievement, as Powell and Downey (1997) indicated that opposite-sex parents may be a positive role model in the household which can compensate the same-sex role models that children may be following during their outside-household lives (schools, social interactions, etc.) .

Third, the *child qualities* that are supported and encouraged by society are, depending on the countries, 1) Effort, responsibility, creativity and respect; 2) Religion and moral values; and 3) Long-term perspective. We see that the first group of qualities has a positive effect on scores, but the second one and –to a lesser extent– the third always have a negative impact on scores when significant. Besides, the effect is of similar size for boys and girls, so its contribution to the gender gap is not robust, except in the case of effort, responsibility, creativity and respect, which decreases the gender gap in reading but widens it in maths, because it

favours boys more than girls, that is, if boys are provided with more "girlish" attributes they fare better at school (Frosh, Phoenix, and Pattman 2002).

Finally, we include *risk-aversion* because there is an ongoing debate in economics regarding gender attitudes towards risk-aversion, which frequently are found to be on average higher in women (Bardasi, Sabarwal, and Terrel 2011; Boehe and Cruz 2013; Booth and Katic 2013; Booth and Nolen 2012, 2015; Caliendo, Fossen, Kritikos, and Wetter 2015; Stefani and Vacca 2015). We consider four risk-aversion factors: 1) Confidence in own ability and desirability of starting a new business; 2) Provided funding for a new business; 3) Fear of starting a new business; and 4) High status of entrepreneurship. Whilst the first (third) factor always has a positive (negative) effect on students' scores, pointing towards a negative role of society-wide risk-aversion on student performance, the role of the other two factors is less clear, although it is negative more often than not. This result can be interpreted as originating in a substitution effect whereby countries where entrepreneurship has a high status and easy funding tend to draw young people away from investing in their studies (Werner 2011; Watt 2015). Moreover, the confidence in own ability and desirability of starting a new business increase the gender gap in maths and decrease it in reading as these factors benefit boys relatively more in both subjects. The availability of funding for a new business and the fear of starting a new business increase the gender gap in maths as boys respond more positively to the former and girls respond more negatively to the latter. The high status of entrepreneurship seems to present gender differentiated effects but without a robust pattern.

All in all, the results show that countrywide cultural differences are correlated with average students' performance and, in particular, with the average gender gap in reading and maths.

4.2 Behavior at the extremes of the scores distribution

Now, building on this first model, we split the sample into those at the bottom and higher positions of the scores distribution. We pay specific attention to the best and worst performers according to the PISA (OCDE 2010; OECD 2014b) grouping (those below level 2 are the "lowest performers" and those above level 4 are "top performers")[6]. Table A.3 shows the proportion of students located under level 2 and above level 4 in PISA, by country; the reported figures make clear that some South American countries (Argentina, Brazil and Colombia), concentrate the highest proportion of low achievers (at least two-thirds of students are located under level 2 in mathematics competence –PISA, 2012–), whilst top performers are mainly

[6] Concretely, the cut point for lowest performers (level 2 cut point) in reading is 407, while for maths it is a score of 420. In the case of top performers (level 5 cut point), it is a score of 626 in reading and of 607 in maths.

located in Asian (Hong-Kong and South-Korea) and North-European countries (such as Finland, Netherlands and Switzerland).

The regression results for the subsamples of lowest and top performers are provided in Tables 2 and 3, respectively. Overall, there are few changes with respect to the average results of Table 1, especially for the lowest performers, who take up a third of the full sample, compared to a ninth for top performers. The regressors explain between 27% and 41% of the variation in scores for the whole distribution (as given by the R-squared), 6-15% in the bottom group and 3-8% in the top group, where individual idiosyncrasies may become more important. Note that the average score for the bottom group is about half that of the top group.

-Insert Tables 2 and 3 here-

Regarding the lowest performers, we see that the signs of the coefficients are the same as in the whole sample for the majority of regressors. One of the few exceptions is in child qualities(long-term perspective), which has a positive effect on the scores of the lowest performers, possibly because the social focus on the importance of keeping at studying and the observed long-term effects of poor performance is an incentive for low performers. The other exception is that in the group of poor performers Asian countries only have an unexplained advantage in the maths scores of girls, what does not come to a surprise bearing in mind the low proportion of low performers among Asian countries.

The group of top performers shows a more distinctive behavior compared to the rest of the sample. At the top end of the sample, students with immigrant parents perform better on average compared to natives, although the difference does not exceed 5 points on average and is mostly linked to the better performance of girls with immigrant parents, who possibly perceive a relatively larger premium from committing to their studies (Rumbaut 2005; Feliciano 2012). Moreover, the structure of the household is not significant for high performers (at the standard 5% level). The support given by society to the child qualities of religion and moral values has a positive effect on the reading scores of top performers, although it has a negative effect on the maths scores of the best male students, presumably because in such societies the reading of religious texts and books is encouraged, especially in the case of boys (Jeynes 2009). Regarding gender opinions, the acceptance of alternative family forms and women's independence has sparse negative effects on top performers. Finally, regarding the risk-aversion factors, in the group of top performers the availability of funding for a new business is the one with more persistent (negative) effects, lending support to the idea of the existence of a substitution effect that draws young people away from investing in their studies.

5 Conclusions

Historically, gender questions on academic performance were focused on girls, mainly due to their lower participation in the educational system. Currently, thanks to the increasing information on the educational outcomes of students –with the publication of the results of international testing programs– this historical trend has turned to a higher academic achievement of girls –as compared to boys– particularly in reading –subject that is usually stereotyped as feminine–, what has caused a major turn to be taken on this issue. Some of the previous literature considers that these gender differences are explained through biological differences without any consideration of the impact of social environment on students' learning, achievement, motivation and attitudes. To overcome this, throughout the entire text we have evaluated the average effect of both micro-level and country-specific cultural factors on the differential educational performance of boys and girls, as well as explored their impact along the performance distribution.

The results of this research have shown that the socio-economic status of the household and family structure affect educational performance and gender gap in a significant way, as boys are more negatively affected than girls by living without parents or at a single-parent home and also tends to benefit less from higher socio-economic status. Additionally, the fact that we find a substantial number of country-level factors that are highly significant demonstrates that students' performance in an international setting is affected by a range of cultural and institutional differences across countries. In fact we found that the unexplained gender gap is lower outside Europe, as in Latin American countries girls perform less badly and in Asian countries girls perform less well compared to boys. This could mean that part of the gender gap in these regions can be due to their society's institutions being unfavorable to girls.

Further, it is essential to foster entrepreneurship attitudes among tertiary education students; on the contrary, until high school education years it could be counterproductive. It is also relevant to enhance girls' self-confidence in business management abilities, as they show a higher average risk-aversion than boys and they are also more affected by a range of gender stereotypes.

We suggest that parents should make an effort and get implied in reducing their preconceived gendered ideas. Schools should also stop reinforcing and supporting gender stereotyped roles, like that of potentially attributing males' academic success to innate intelligence and girls' achievements to hard work. At the same time school should strengthen instructional mechanisms to compensate the stereotyping environment that children could be facing at home. In other words, even if schools do not create the gap, they should have an active

role operating through how students and teachers construct gender in the classroom and how this instructional environment may be exported to the student's home, to ameliorate the gap.

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Appendix

Table A1. Descriptive statistics.

		PISA 2009						PISA 2012					
		Boys			Girls			Boys			Girls		
		Obs.	Mean	S.d.	Obs.	Mean	S.d.	Obs.	Mean	S.d.	Obs.	Mean	S.d.
Immigrant status	**Native**	87,622	0.92	0.26	89,389	0.93	0.26	86,568	0.92	0.28	87,919	0.92	0.27
	Immigrant	87,622	0.08	0.26	89,389	0.07	0.26	86,568	0.08	0.28	87,919	0.08	0.27
ESCS	**Very high**	87,622	0.26	0.44	89,389	0.25	0.43	86,568	0.26	0.44	87,919	0.25	0.43
	High	87,622	0.25	0.44	89,389	0.25	0.43	86,568	0.26	0.44	87,919	0.25	0.43
	Low	87,622	0.25	0.43	89,389	0.25	0.43	86,568	0.25	0.43	87,919	0.25	0.43
	Very low	87,622	0.24	0.42	89,389	0.25	0.44	86,568	0.24	0.43	87,919	0.25	0.43
Structure of the household	**Both parents live at home**	87,622	0.83	0.38	89,389	0.82	0.39	86,568	0.83	0.38	87,919	0.82	0.38
	Single-parent home	87,622	0.14	0.34	89,389	0.15	0.36	86,568	0.14	0.35	87,919	0.15	0.36
	Living without parents	87,622	0.04	0.19	89,389	0.03	0.18	86,568	0.03	0.18	87,919	0.03	0.17
Education system characteristics	**Factor 1**	22	0	1.71	22	0	1.71	22	0	1.71	22	0	1.71
	Factor 2	22	0	1.4	22	0	1.4	22	0	1.4	22	0	1.4
Views on gender roles	**Factor 1**	22	0	1.8	22	0	1.8	22	0	1.8	22	0	1.8
Gender opinions	**Factor 1**	16	0	2.14	16	0	2.14	16	0	2.14	16	0	2.14
	Factor 2	16	0	1.24	16	0	1.24	16	0	1.24	16	0	1.24
	Factor 3	16	0	1.03	16	0	1.03	16	0	1.03	16	0	1.03
Child qualities	**Factor 1**	22	0	1.87	22	0	1.87	22	0	1.87	22	0	1.87
	Factor 2	22	0	1.59	22	0	1.59	22	0	1.59	22	0	1.59
	Factor 3	22	0	1.23	22	0	1.23	22	0	1.23	22	0	1.23
Risk aversion	**Factor 1**	22	0	2.48	22	0	2.48	22	0	2.48	22	0	2.48
	Factor 2	22	0	1.45	22	0	1.45	22	0	1.45	22	0	1.45
	Factor 3	22	0	1.32	22	0	1.32	22	0	1.32	22	0	1.32
	Factor 4	22	0	1.02	22	0	1.02	22	0	1.02	22	0	1.02
Countries	**Latino American countries**	22	0.27	0.46	22	0.27	0.46	22	0.27	0.46	22	0.27	0.46
	Asian countries	22	0.09	0.29	22	0.09	0.29	22	0.09	0.29	22	0.09	0.29
	Other countries	22	0.64	0.49	22	0.64	0.49	22	0.64	0.49	22	0.64	0.49

Source: Author's own calculation.

Table 1. OLS Estimation of the conditional effect on academic achievement (PISA scores) of the set of regressors; whole sample.

	PISA 2009				PISA 2012			
	Reading		Maths		Reading		Maths	
Variables	**Boys**	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
Immigrant (Reference: Native)	-27.799***	-28.619***	-31.621***	-31.483***	-28.734***	-27.191***	-27.643***	-26.616***
	(1.092)	(1.002)	(1.061)	(0.989)	(1.056)	(0.942)	(1.037)	(0.953)
ESCS (Reference: Very low)								
Very high	76.621***^{S}	78.867***^{S}	74.745***^{S}	77.718***^{S}	74.913***	74.840***	76.078***	76.675***
	(0.786)	(0.708)	(0.764)	(0.699)	(0.800)	(0.706)	(0.786)	(0.715)
High	43.238***^{S}	47.145***^{S}	40.804***^{S}	44.408***^{S}	43.695***	45.263***	43.028***^{S}	45.328***^{S}
	(0.790)	(0.703)	(0.767)	(0.694)	(0.799)	(0.707)	(0.785)	(0.715)
Low	24.190***^{S}	27.458***^{S}	23.391***^{S}	25.937***^{S}	23.948***	25.206***	22.911***	24.315***
	(0.792)	(0.699)	(0.769)	(0.690)	(0.804)	(0.699)	(0.790)	(0.707)
Structure of the household (Reference: Both parents live at home)								
Single-parent home	-4.424***^{S}	-1.920***^{S}	-7.520***^{S}	-4.895***^{S}	-2.631***	-1.973***	-5.047***	-4.727***
	(0.815)	(0.709)	(0.791)	(0.700)	(0.816)	(0.706)	(0.802)	(0.714)
Living without parents	-58.167***^{S}	-46.189***^{S}	-55.381***^{S}	-43.868***^{S}	-53.126***^{S}	-39.272***^{S}	-53.818***^{S}	-40.858***^{S}
	(1.477)	(1.434)	(1.435)	(1.416)	(1.631)	(1.495)	(1.602)	(1.514)
Education system characteristics (Topic D) - NES								
Factor 1	-20.439***^{S}	-17.927***^{S}	-17.798***^{S}	-13.778***^{S}	-17.435***	-16.336***	-15.597***^{S}	-10.969***^{S}
	(0.518)	(0.462)	(0.503)	(0.456)	(0.503)	(0.448)	(0.495)	(0.454)
Factor 2	17.869***^{S}	15.631***^{S}	17.787***^{S}	13.028***^{S}	12.493***^{S}	11.106***^{S}	13.302***^{S}	9.006***^{S}
	(0.503)	(0.457)	(0.489)	(0.451)	(0.498)	(0.447)	(0.490)	(0.453)
Views on gender roles (Topic P) - NES								
Factor 1	9.405***^{S}	11.143***^{S}	6.169***	5.659***	5.986***^{S}	9.001***^{S}	6.144***^{S}	4.758***^{S}
	(0.379)	(0.344)	(0.368)	(0.339)	(0.371)	(0.331)	(0.365)	(0.335)
Gender opinions - WVS								
Factor 1	-5.215***	-4.681***	-8.232***^{S}	-6.947***^{S}	-7.899***^{S}	-7.225***^{S}	-6.875***^{S}	-5.818***^{S}
	(0.288)	(0.259)	(0.280)	(0.255)	(0.295)	(0.259)	(0.290)	(0.262)
Factor 2	1.947***^{S}	-1.023**^{S}	1.817***	2.453***	1.878***^{S}	0.412^{S}	6.721***^{S}	7.904***^{S}
	(0.496)	(0.453)	(0.481)	(0.447)	(0.495)	(0.441)	(0.486)	(0.446)
Factor 3	19.151***^{S}	13.480***^{S}	13.672***	12.282***	7.351***^{S}	3.837***^{S}	2.047**	1.732**
	(0.913)	(0.827)	(0.887)	(0.816)	(0.896)	(0.802)	(0.880)	(0.812)
Missing flag	42.160***^{S}	27.347***^{S}	38.671***^{S}	26.451***^{S}	41.464***^{S}	29.183***^{S}	31.172***^{S}	25.978***^{S}
	(1.036)	(0.929)	(1.007)	(0.917)	(1.052)	(0.940)	(1.033)	(0.952)
Child qualities - WVS								
Factor 1	10.372***	9.855***	10.830***^{S}	9.848***^{S}	10.668***^{S}	9.056***^{S}	11.982***^{S}	10.695***^{S}
	(0.332)	(0.302)	(0.323)	(0.298)	(0.338)	(0.301)	(0.332)	(0.304)

Factor 2	-2.698***	-3.717***	-7.854***	-9.254***	0.262^{S}	-3.613***^{S}	-4.922***	-5.944***
	(0.682)	(0.621)	(0.663)	(0.613)	(0.702)	(0.636)	(0.690)	(0.644)
Factor 3	-0.918*	-0.756	-1.022**	-1.116**	-1.875***^{S}	1.558***^{S}	0.099	0.023
	(0.517)	(0.466)	(0.502)	(0.460)	(0.536)	(0.475)	(0.526)	(0.481)
Risk aversion - APS								
Factor 1	5.210***^{S}	0.785**^{S}	5.255***^{S}	2.791***^{S}	1.156***^{S}	-0.078^{S}	1.760***^{S}	0.147^{S}
	(0.384)	(0.342)	(0.373)	(0.338)	(0.395)	(0.352)	(0.388)	(0.356)
Factor 2	3.330***^{S}	0.912**^{S}	-0.999**	-1.085***	2.783***^{S}	-1.511***^{S}	-0.698*	-1.533***
	(0.408)	(0.375)	(0.397)	(0.370)	(0.414)	(0.376)	(0.407)	(0.381)
Factor 3	-3.870***^{S}	-7.279***^{S}	-1.590***	-2.040***	-6.740***^{S}	-9.002***^{S}	-4.351***^{S}	-3.244***^{S}
	(0.396)	(0.363)	(0.385)	(0.358)	(0.399)	(0.356)	(0.392)	(0.361)
Factor 4	-9.172***^{S}	-7.138***^{S}	-7.499***^{S}	-6.046***^{S}	1.163*^{S}	-0.249^{S}	-1.147**	-0.293
	(0.581)	(0.521)	(0.564)	(0.514)	(0.595)	(0.531)	(0.585)	(0.538)
Country (Ref: Other countries)								
Latino American countries	-129.823***^{S}	-107.502***^{S}	-140.171***^{S}	-124.625***^{S}	-97.102***	-91.537***	-111.801***^{S}	-104.556***^{S}
	(2.605)	(2.320)	(2.530)	(2.290)	(2.583)	(2.292)	(2.537)	(2.320)
Asian countries	69.691***^{S}	58.467***^{S}	77.477***^{S}	68.824***^{S}	85.676***^{S}	56.781***^{S}	94.349***^{S}	82.010***^{S}
	(3.309)	(3.029)	(3.214)	(2.990)	(3.387)	(3.070)	(3.327)	(3.107)
Constant	443.437***	473.941***	472.668***	456.104***	435.963***	473.176***	465.252***	451.515***
	(1.019)	(0.909)	(0.990)	(0.897)	(1.026)	(0.902)	(1.007)	(0.913)
Observations	87,622	89,389	87,622	89,389	86,568	87,919	86,568	87,919
R-squared	0.278	0.347	0.363	0.417	0.279	0.343	0.335	0.388

Note: Estimation method: Ordinary Least Squares.
^{S} Indicates that the differences between boys and girls are significant.
Coefficient: ***Significant at 1%, ** significant at 5%, * significant at 10%.
Source: Author's own calculation.

Table 2. OLS Estimation of the conditional effect on academic achievement of the set of regressors; students under level 2 in PISA –lowest performers–.

	PISA 2009				PISA 2012			
	Reading		Maths		Reading		Maths	
Variables	**Boys**	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
Immigrant (Reference: Native)	-8.480***	-9.925***	-7.132***^{S}	-11.795***^{S}	-11.199***	-11.075***	-5.975***	-7.785***
	(1.096)	(1.277)	(1.104)	(1.038)	(1.096)	(1.259)	(0.977)	(0.936)
ESCS (Reference: Very low)								
Very high	14.558***^{S}	18.591***^{S}	14.865***^{S}	22.551***^{S}	16.285***	15.692***	15.825***^{S}	23.011***^{S}
	(0.920)	(1.167)	(0.866)	(0.830)	(0.975)	(1.149)	(0.832)	(0.782)
High	10.264***	12.075***	10.358***^{S}	15.507***^{S}	10.968***	9.024***	10.284***^{S}	15.134***^{S}
	(0.791)	(0.910)	(0.736)	(0.685)	(0.824)	(0.914)	(0.696)	(0.659)
Low	7.670***	7.708***	6.985***^{S}	9.444***^{S}	6.468***	6.166***	7.277***^{S}	8.952***^{S}
	(0.742)	(0.809)	(0.695)	(0.631)	(0.774)	(0.799)	(0.651)	(0.596)
Structure of the household (Reference: Both parents live at home)								
Single-parent home	-2.099**	-0.490	-3.531***	-3.110***	-1.091	-2.406***	0.084	-1.306**
	(0.828)	(0.882)	(0.759)	(0.673)	(0.851)	(0.889)	(0.700)	(0.638)
Living without parents	-19.511***^{S}	-13.963***^{S}	-19.346***^{S}	-22.355***^{S}	-18.206***^{S}	-8.501***^{S}	-19.457***	-18.814***
	(1.057)	(1.161)	(0.934)	(0.976)	(1.169)	(1.165)	(0.948)	(0.958)
Education system characteristics (Topic D) - NES								
Factor 1	-9.482***^{S}	-5.963***^{S}	-5.881***^{S}	-4.389***^{S}	-7.494***	-6.099***	-3.449***	-2.268***
	(0.640)	(0.911)	(0.641)	(0.621)	(0.635)	(0.792)	(0.548)	(0.538)
Factor 2	8.108***^{S}	4.807***^{S}	5.195***^{S}	3.460***^{S}	6.647***	5.776***	3.570***	3.239***
	(0.633)	(0.917)	(0.646)	(0.628)	(0.629)	(0.794)	(0.534)	(0.529)
Views on gender roles (Topic P) - NES								
Factor 1	5.316***^{S}	3.779***^{S}	3.186***	2.782***	2.120***	2.939***	2.624***	2.497***
	(0.478)	(0.686)	(0.498)	(0.483)	(0.469)	(0.585)	(0.411)	(0.403)
Gender opinions - WVS								
Factor 1	-1.150***^{S}	0.058^{S}	-0.587*^{S}	0.567*^{S}	-2.511***^{S}	-1.419***^{S}	-1.254***	-0.770**
	(0.332)	(0.450)	(0.333)	(0.325)	(0.342)	(0.415)	(0.308)	(0.305)
Factor 2	1.746***	1.938**	2.111***	2.016***	2.246***^{S}	4.447***^{S}	3.527***	4.563***
	(0.576)	(0.783)	(0.559)	(0.537)	(0.593)	(0.726)	(0.496)	(0.474)
Factor 3	10.122***^{S}	7.100***^{S}	4.944***	2.759**	6.890***^{S}	2.988**^{S}	1.332	0.109
	(1.164)	(1.686)	(1.230)	(1.177)	(1.093)	(1.409)	(0.974)	(0.955)
Missing flag	19.159***^{S}	11.063***^{S}	15.803***^{S}	11.357***^{S}	19.841***^{S}	15.567***^{S}	8.469***	6.519***
	(1.278)	(1.706)	(1.298)	(1.227)	(1.314)	(1.636)	(1.153)	(1.127)
Child qualities - WVS								
Factor 1	4.023***	4.387***	4.366***	4.633***	3.202***	2.977***	3.280***	3.633***

	(0.439)	(0.662)	(0.434)	(0.434)	(0.442)	(0.566)	(0.378)	(0.376)
Factor 2	-4.195***^{S}	-1.833^{S}	-2.369**	-1.325	-2.351**	-2.115	-1.518*	0.166
	(0.992)	(1.427)	(1.049)	(1.003)	(1.017)	(1.315)	(0.903)	(0.894)
Factor 3	5.188***^{S}	2.636***^{S}	2.201***^{S}	-1.234**^{S}	4.584***	4.819***	3.223***^{S}	0.702^{S}
	(0.590)	(0.757)	(0.601)	(0.568)	(0.637)	(0.753)	(0.545)	(0.526)
Risk aversion - APS								
Factor 1	4.582***^{S}	1.560***^{S}	1.775***^{S}	-0.565^{S}	2.703***^{S}	1.541***^{S}	0.786*^{S}	-1.490***^{S}
	(0.448)	(0.568)	(0.464)	(0.427)	(0.461)	(0.552)	(0.407)	(0.391)
Factor 2	0.222	0.618	-0.459^{S}	0.716^{S}	-0.561	-1.736***	-0.970**	-0.503
	(0.487)	(0.656)	(0.516)	(0.494)	(0.497)	(0.643)	(0.438)	(0.438)
Factor 3	-1.687***^{S}	-3.007***^{S}	-1.498***^{S}	-2.765***^{S}	-0.969**^{S}	-2.067***^{S}	-2.335***	-2.369***
	(0.435)	(0.546)	(0.433)	(0.408)	(0.450)	(0.549)	(0.396)	(0.383)
Factor 4	-6.744***	-5.560***	-3.849***^{S}	-2.193***^{S}	-1.201*^{S}	-3.280***^{S}	-1.958***	-1.304**
	(0.631)	(0.778)	(0.624)	(0.588)	(0.648)	(0.743)	(0.566)	(0.550)
Country (Ref: Other countries)								
Latino American countries	-55.381***^{S}	-35.888***^{S}	-35.264***	-28.860***	-37.508***	-33.023***	-24.692***	-25.574***
	(2.988)	(4.034)	(3.065)	(2.950)	(2.958)	(3.662)	(2.592)	(2.563)
Asian countries	0.066	10.277	4.960^{S}	18.709***^{S}	0.383	0.451	0.024^{S}	11.882***^{S}
	(5.429)	(9.215)	(5.478)	(5.750)	(5.077)	(6.805)	(4.507)	(4.610)
Constant	357.355***	364.102***	371.504***	365.916***	349.604***	363.903***	370.061***	367.073***
	(1.186)	(1.656)	(1.236)	(1.182)	(1.137)	(1.386)	(1.004)	(0.981)
Observations	26,003	16,705	24,145	29,457	24,499	15,338	23,561	28,330
R-squared	0.090	0.102	0.097	0.143	0.063	0.072	0.094	0.149

Note: Estimation method: Ordinary Least Squares.
^{S} Indicates that the differences between boys and girls are significant.
Coefficient: ***Significant at 1%, ** significant at 5%, * significant at 10%.
Source: Author's own calculations.

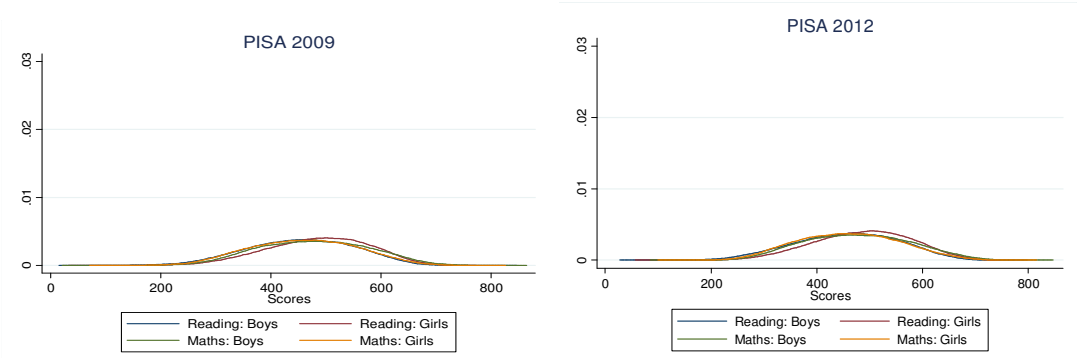
Table 3. OLS Estimation of the conditional effect on academic achievement of the set of regressors; students above level 4 in PISA –top performers–.

	PISA 2009				PISA 2012			
	Reading		Maths		Reading		Maths	
Variables	**Boys**	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
Immigrant (Reference: Native)	0.776	2.987**	-1.388^{S}	2.749*^{S}	4.439***	3.558**	0.940	-0.095
	(1.838)	(1.427)	(1.347)	(1.473)	(1.651)	(1.384)	(1.358)	(1.465)
ESCS (Reference: Very low)								
Very high	6.500***^{S}	9.940***^{S}	11.216***	9.350***	5.057***^{S}	9.222***^{S}	12.620***	12.250***
	(1.808)	(1.254)	(1.121)	(1.302)	(1.601)	(1.294)	(1.176)	(1.354)
High	3.104	5.281***	4.776***	2.657*	3.181*	5.066***	6.707***	7.115***
	(1.896)	(1.320)	(1.182)	(1.373)	(1.684)	(1.357)	(1.234)	(1.432)
Low	1.802	3.788***	1.820	1.704	0.289	2.880**	2.670**	3.760**
	(2.044)	(1.403)	(1.255)	(1.467)	(1.819)	(1.440)	(1.316)	(1.521)
Structure of the household (Reference: Both parents live at home)								
Single-parent home	0.863	1.207	-1.617	-0.413	-1.139^{S}	1.867*^{S}	-1.416	0.546
	(1.393)	(0.974)	(1.068)	(1.157)	(1.331)	(1.069)	(1.112)	(1.203)
Living without parents	11.534*	-3.735	3.000	-4.239	-3.647	-1.378	-6.159	-7.072
	(6.224)	(4.762)	(5.143)	(7.094)	(8.534)	(6.470)	(5.299)	(6.181)
Education system characteristics (Topic D) - NES								
Factor 1	-0.350	-1.159	-0.965^{S}	1.972*^{S}	-2.210*	-1.177	-3.071***^{S}	0.212^{S}
	(1.351)	(0.934)	(0.979)	(1.100)	(1.217)	(0.966)	(0.927)	(1.066)
Factor 2	-0.123	1.220	3.671***^{S}	1.127^{S}	0.895^{S}	-1.288^{S}	2.792***^{S}	1.048^{S}
	(0.996)	(0.796)	(0.770)	(0.908)	(1.070)	(0.825)	(0.788)	(0.853)
Views on gender roles (Topic P) - NES								
Factor 1	0.401	0.625	0.481	-0.175	0.613	0.785	0.595	0.069
	(0.646)	(0.558)	(0.581)	(0.723)	(0.762)	(0.593)	(0.582)	(0.669)
Gender opinions - WVS								
Factor 1	-0.152^{S}	-3.169***^{S}	0.491^{S}	-1.331^{S}	-1.836	-0.601	-1.203*	-1.636**
	(1.175)	(1.003)	(1.043)	(1.314)	(1.728)	(1.355)	(0.709)	(0.736)
Factor 2	0.849^{S}	-3.213***^{S}	0.767	0.649	-0.405	-1.283	-2.223**^{S}	-0.132^{S}
	(1.334)	(1.059)	(1.211)	(1.585)	(1.586)	(1.296)	(1.018)	(1.223)
Factor 3	-2.177	0.276	2.056**^{S}	-1.720^{S}	0.741	-0.629	1.340^{S}	-2.365**^{S}
	(1.513)	(1.029)	(1.021)	(1.092)	(1.513)	(1.154)	(1.107)	(1.184)
Missing flag	6.402**	9.696***	5.671***^{S}	1.212^{S}	4.251	1.656	8.200***	7.764***
	(3.005)	(2.092)	(2.067)	(2.320)	(2.879)	(2.335)	(1.891)	(2.054)
Child qualities - WVS								
Factor 1	1.373	0.701	1.838***	0.573	0.706	0.583	1.548**	2.222***
	(0.840)	(0.699)	(0.661)	(0.881)	(0.916)	(0.707)	(0.631)	(0.769)
Factor 2	2.901***	2.933***	-3.566***^{S}	-1.371^{S}	2.625**	1.700*	-1.969**^{S}	1.150^{S}
	(0.947)	(0.809)	(0.740)	(0.874)	(1.127)	(0.879)	(0.765)	(0.829)
Factor 3	-1.247^{S}	1.349^{S}	-0.745	1.102	0.518	-0.649	1.528*	0.592
	(1.088)	(0.870)	(1.013)	(1.251)	(1.465)	(1.187)	(0.874)	(0.936)
Risk aversion - APS								
Factor 1	-1.342*	0.000	0.977^{S}	-0.692^{S}	-0.113	-0.097	1.983**^{S}	-0.698^{S}

	(0.801)	(0.790)	(0.720)	(0.910)	(1.159)	(0.828)	(0.804)	(0.928)
Factor 2	-0.533	-1.377**	0.301[S]	-2.398***[S]	-0.399	-0.257	-0.794	-1.319**
	(0.872)	(0.671)	(0.687)	(0.826)	(1.144)	(0.862)	(0.609)	(0.649)
Factor 3	-0.988	-0.279	2.374***	0.741	-1.434	-0.588	-0.512	-0.383
	(0.945)	(0.859)	(0.857)	(1.022)	(1.346)	(0.980)	(0.779)	(0.878)
Factor 4	1.850*	0.068	-1.876*	-2.627**	2.257	2.581**	-0.220	0.174
	(1.103)	(1.005)	(1.036)	(1.299)	(1.597)	(1.193)	(1.070)	(1.208)
Country (Ref: Other countries)								
Latino American countries	-0.563	-5.830	-18.109***[S]	-5.853[S]	-11.263**	-12.602***	-23.273***[S]	-7.885[S]
	(5.080)	(3.615)	(4.499)	(5.267)	(5.554)	(4.402)	(4.885)	(5.812)
Asian countries	13.563**	17.269***	10.440**	19.410***	13.570	4.989	18.002***	25.721***
	(5.828)	(5.717)	(4.849)	(6.131)	(8.647)	(6.300)	(4.756)	(5.298)
Constant	641.141***	640.408***	637.309***	629.037***	646.641***	648.224***	637.873***	627.960***
	(2.624)	(2.223)	(1.958)	(2.447)	(3.314)	(2.456)	(1.833)	(2.055)
Observations	2,695	5,204	10,034	6,142	3,144	5,788	10,187	6,623
R-squared	0.036	0.042	0.068	0.065	0.026	0.039	0.084	0.051

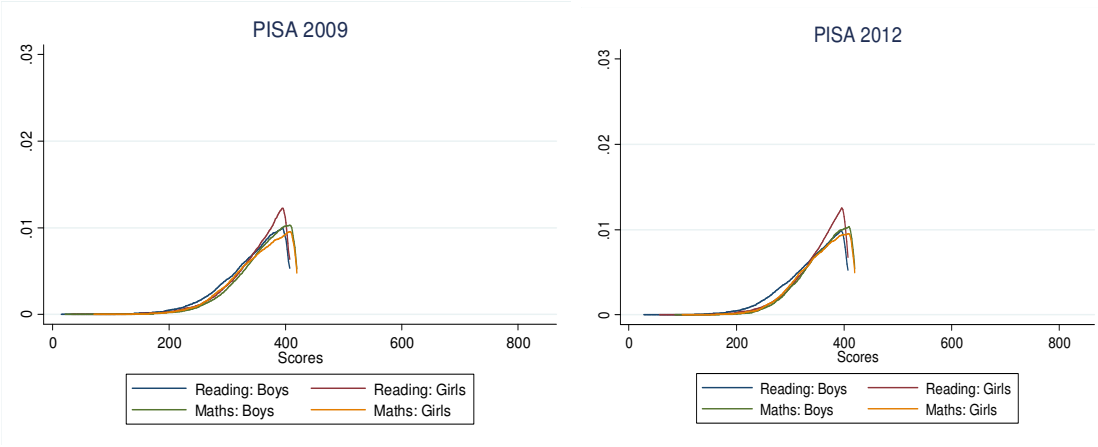
Note: Estimation method: Ordinary Least Squares. [S] Indicates that the differences between boys and girls are significant. Coefficient: ***Significant at 1%, ** significant at 5%, * significant at 10%. Source: Author's own calculation.

Figure 1. Kernel distribution of scores; whole sample



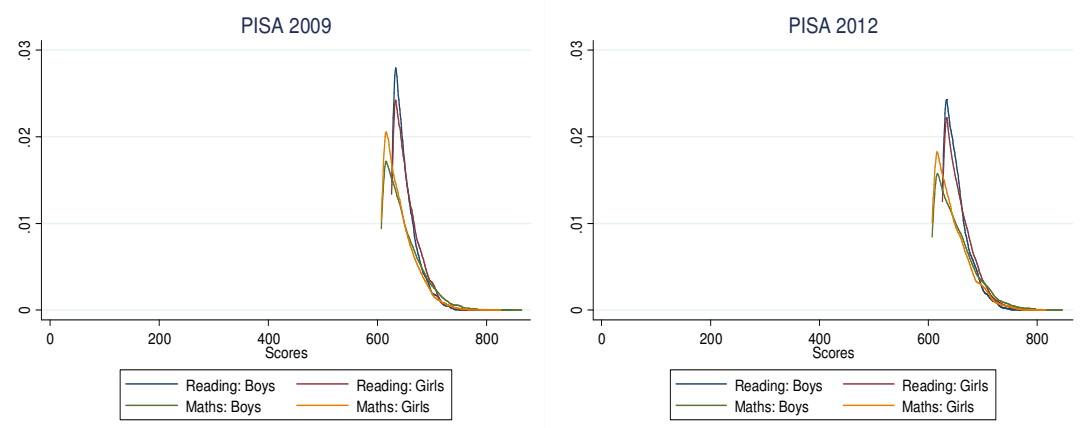
Source: Author's own calculation.

Figure 2. Kernel distribution of scores; subsample of lowest performers



Source: Author's own calculation.

Figure 3. Kernel distribution of scores; subsample of top performers



Source: Author's own calculation.